Nearly all conventional computer graphics systems use some form of Geometry-based rendering (GBR) technique to render novel views of an object/scene from various different view positions. They produce images from geometric model of the scene descriptions by simulating the interaction of light with objects. However, model generation is a time consuming process and is highly dependent on the scene complexity. Further, such systems have a limited ability to construct a photo-realistic virtual environment. Image-based rendering (IBR) is a new powerful alternative approach to computer graphics in which two-dimensional images, rather than three dimensional models, act as the underlying scene representation. IBR replaces the geometric scene description with reference images and the simulation process with data interpolation. It produces realistic-looking 3D graphics at a relatively low cost and its rendering time is usually constant and does not dependent upon the scene complexity.

This thesis has reviewed the fundamental theory, methods and applications of various IBR techniques and contributed a family of algorithms for improvement of these techniques. Our work is based on Image warping (or 3D warping), an IBR technique that allows a 2D reference image to be viewed from a different view position. This kind of transformation is important in many mass market applications including e-commerce, virtual reality, virtual tours etc. which synthesize realistic looking novel views of the reference images.
First, we propose a computationally efficient framework for 3D warping technique. In the proposed approach, we perform the restructuring of warping order cases and utilize scan line coherency to do reference to desired image mapping efficient. The proposed framework achieves 7-8% average improvement in rendering time as compared to our evaluated traditional 3D warping approach in Java environment.

Then we further propose a framework based on the computationally efficient 3D warping technique to perform interactive rendering on mobile devices. The performance of the proposed framework is evaluated with JavaME Phone emulator and on some real Java-based mobile devices. Further, the performance of the framework is compared with our evaluated performance of geometry-based technique and the experimental results show that the proposed framework performs better in terms of rendering time, visual quality and memory requirements. In mobile/ handheld devices where hardware resources are limited, this approach is particularly useful for applications like visualization, navigation system etc.

However, an issue associated with mobile devices is that processing takes considerable time if the reference image is of large size. As the mobile devices have limited screen-size, therefore, methods to down-sample these large images can be utilized. We further propose a framework that extends the computationally efficient 3D warping technique in wavelet-domain to render novel views of down-sampled images in mobile devices. The proposed framework is implemented using Android Development Tools (ADT). The performance of the proposed framework is evaluated with Android Virtual Device (AVD) emulator and real android smartphones. The experimental results show that the
proposed framework gives 39-41% better results in terms of rendering time as compared to the computationally efficient 3D warping technique if the framework down-sample the images to one quarter of its original size. Further, the compressed rebuilt image has visual quality close to the original image.